PROPOSED PLAN AND DRAFT MODIFICATION OF THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE RESOURCE CONSERVATION AND RECOVERY ACT PERMIT OPERABLE UNIT 1: 881 HILLSIDE AREA

United States Department of Energy (DOE) | **Jefferson County, Colorado** | **May 1996**

DOE Announces the Preferred Alternative to Address OU 1, 881 HILLSIDE AREA

The responsibility for cleanup of the Rocky Flats Environmental Technology Site (Rocky Flats), (formerly known as the Rocky Flats Plant) has been assigned to the U.S. Department of Energy (DOE). The site is located north of Golden, in Jefferson County Colorado.

Cleanup at Rocky Flats is being conducted under the ***Comprehensive Environmental Response Compensation and Liability Act (CERCLA)***[1] and the ***Resource Conservation and Recovery Act (RCRA)*** implemented through the ***Colorado Hazardous Waste Act (CHWA)***. The specific requirements and responsibilities for the Rocky Flats cleanup are currently outlined in the ***Interagency Agreement (IAG)*** between DOE, the Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) dated January 1991. This document is consistent with the IAG as well as the draft ***Rocky Flats Cleanup Agreement*** (RFCA), which is currently out for public comment and will replace the IAG as the governing cleanup agreement when it is finalized. This document is also consistent with the draft ***Rocky Flats Vision***.

The subject of this document, which is a combination Proposed Plan and Draft RCRA Permit Modification,

Mark Your Calendar: Opportunities for Public Involvement

Public Comment Period:
May 13, 1996 to July 12, 1996

Public Hearing Location:
Arvada Center for the Arts and Humanities
6901 Wadsworth Boulevard
Arvada, Colorado

Public Hearing Time and Date:
June 19, 1996
6:30 p.m. - 7:30 p.m.

Send Comments to:
DOE Office of Communications and Economic Development
P.O. Box 928, B115
Golden, CO 80402-0928

Information Repositories:
Rocky Flats Public Reading Room
Front Range Community College
Level B
3645 West 112th Avenue
Westminster, CO 80030
(303) 469-4435

EPA Superfund Records Center
999 18th Street, Suite 500
Denver, CO 80202
(303) 312-6473

Points of Contact:
DOE: Mike Konczal, (303) 966-5993
CDPHE: Chris Gilbreath, (303) 692-3371
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8485 Kipling
Arvada, CO 80005
(303) 456-0806

[1] Words shown in ***bold italics*** on the first mention *are defined in the glossary at the end of this* Proposed Plan.

is Rocky Flats ***Operable Unit 1*** (OU 1), 881 Hillside Area. Lead regulatory agency responsibilities are shared by both the EPA and CDPHE. OU 1 is composed of eleven ***Individual Hazardous Substance Sites (IHSSs)*** 102, 103, 104, 105.1, 105.2, 106, 107, 119.1, 119.2, 130, and 145. These IHSSs are areas that were historically used to store and/or dispose of hazardous and non-hazardous material, or are areas where releases of hazardous material occurred or are thought to have occurred.

The purpose of the *Proposed Plan And Draft Modification Of The Rocky Flats Environmental Technology Site RCRA Permit for Operable Unit 1: 881 Hillside Area* (***Proposed Plan***) is to announce DOE's ***Preferred Alternative*** for OU 1. This Proposed Plan meets the requirements of CERCLA section 117(a); the Colorado Hazardous Waste Regulations (6 CCR 1007-3, 100.63); and the IAG; and is consistent with the draft RFCA. The Proposed Plan and the ***Administrative Record*** serve as the basis for the ***Corrective Action Decision/Record of Decision (CAD/ROD)*** for OU 1. The Draft Modification of the Rocky Flats RCRA Permit is used to incorporate remedial action decisions at Rocky Flats into the Site's RCRA Permit. CDPHE issues the Final Hazardous Waste Permit Modification once the remedial decision process is completed.

The Preferred Alternative for OU 1 presented in this Proposed Plan is *Soil Excavation and Groundwater Pumping.* The Preferred Alternative for OU 1 is protective of human health and the environment and was selected by the ***Dispute Resolution Committee*** (DRC) on August 25, 1995, as part of the dispute resolution process defined within the IAG. The DRC based its decision on IHSS 119.1. The DRC was interested in controlling groundwater contamination through source removal at IHSS 119.1. The DRC also considered consistency with the draft Rocky Flats Vision as it made its decision on the Preferred Alternative. The remaining IHSSs within OU 1 are already in a protective state with regard to human health and the environment. Thus, DOE anticipates taking no further action relative to the remaining OU 1 IHSSs.

Recently several sitewide initiatives have been started at Rocky Flats. The two initiatives that significantly impact OU 1 are the Environmental Restoration Ranking and the Action Levels and Standards Framework for Surface Water, Groundwater, and Soils (Action Level Framework). These two initiatives have been proposed as part of the draft RFCA. The Environmental Restoration Ranking ranks IHSSs in order of their relative risk for the purpose of establishing remediation priorities and allocating funding to environmental remediation projects. The Action Level Framework establishes action levels and/or clean up levels to ensure that surface water, groundwater, subsurface soil and surface soil cleanup takes place consistently across the site.

IHSS 119.1 will be remediated consistent with its relative ranking in the Environmental Restoration Ranking. Remediation will consist of subsurface soil excavation, and possible soil treatment and/or disposal. Groundwater associated with OU 1 will be managed consistent with the Action Level Framework and the ***Final Groundwater Conceptual Plan for RFETS.***

The remedial alternatives considered for OU 1 include:

- Alternative 0: *No Action*,
- Alternative 1: *Institutional Controls with the French Drain*,
- Alternative 2: *Groundwater Pumping and Soil Vapor Extraction*,
- Alternative 3: *Groundwater Pumping and Soil Vapor Extraction with Thermal Enhancement*,
- Alternative 4: *Hot Air Injection with Mechanical Mixing*, and
- Alternative 5: *Soil Excavation and Groundwater Pumping.*

The ***Corrective Measures Study/Feasibility Study (CMS/FS)*** for OU 1 presents a detailed discussion of the remedial alternatives listed above. A ***RCRA Facility Investigation/Remedial Investigation (RFI/RI)*** report was completed for OU 1 which presents the nature and extent of contamination associated with the OU. These documents are maintained as part of the Administrative Record for OU 1 and are available for review at the Information Repositories.

PUBLIC INVOLVEMENT PROCESS

Community acceptance is one of the criteria that DOE and the regulatory agencies must evaluate during the process of selecting a final remedy for OU 1. This Proposed Plan is being issued for public review and comment to evaluate community acceptance of the Preferred Alternative.

Although this Proposed Plan identifies *Soil Excavation And Groundwater Pumping* as the preferred alternative for OU 1, the Public is

encouraged to review and comment on all of the remedial alternatives considered.

A public comment period will be held for this Proposed Plan. The public comment period will be from May 13, 1996 to July 12, 1996. A public hearing will be held on June 19, 1996. Comments on the Proposed Plan may be submitted orally or in writing at the public hearing, or mailed directly to the address indicated on page one of this document. Mailed comments must be postmarked no later than July 9, 1996.

Upon timely request, the comment period may be extended. Such a request should be submitted in writing to DOE postmarked no later than June 28, 1996. FAILURE TO RAISE AN ISSUE OR PROVIDE INFORMATION DURING THE PUBLIC COMMENT PERIOD MAY PREVENT YOU FROM RAISING THAT ISSUE OR SUBMITTING SUCH INFORMATION IN AN APPEAL OF THE AGENCIES' FINAL DECISION.

SITE BACKGROUND

Originally the Rocky Flats Environmental Technology Site was named the Rocky Flats Plant (RFP), but during July 1994 RFP was renamed to better reflect its new mission of environmental restoration and the advancement of new and innovative technologies for waste management, characterization, and remediation.

Rocky Flats is a DOE-owned facility, located approximately 16 miles northwest of downtown Denver, Colorado. Rocky Flats occupies approximately 6,550 acres of Federally-owned land in northern Jefferson County, Colorado (see Figure 1).

The majority of Rocky Flats buildings are located within a 400-acre area referred to as the industrial area. The 6,150 acres surrounding the plant buildings provide a buffer zone for the industrial area.

Until 1992, Rocky Flats fabricated nuclear weapon components from plutonium, uranium, beryllium, and stainless steel. Parts made at the plant were shipped elsewhere for assembly. Support activities included chemical recovery and purification of recyclable transuranic radionuclides and research.

The production process at Rocky Flats resulted in the generation of radioactive and non-radioactive hazardous wastes. On-site storage and disposal of these wastes contributed to hazardous and radioactive contamination in soil, surface water, and groundwater. Due to the complex nature of the Rocky Flats site, it has been divided into sixteen Operable Units (OUs). OU 1, the 881 Hillside Area, is the subject of this plan (see Figure 2). The draft RFCA recommends consolidating the sixteen OUs, but OU 1 is to remain separate from the consolidation.

The 881 Hillside Area is located just south and east of Building 881, where most of the OU 1 contamination is thought to have originated. Building 881 was previously used for enriched uranium operations and stainless steel manufacturing. The laboratories in Building 881 were also used to perform analyses of materials generated during production of various components.

OU 1 includes 11 areas identified as Individual Hazardous Substance Sites (IHSSs), where past operational practices may have resulted in environmental contamination. Brief descriptions of the OU 1 IHSSs are presented below.

- **IHSS 102, Oil Sludge Pit Site.** This area is located approximately 180 feet south of Building 881, where 30 to 50 drums of non-radioactive oily sludge were emptied in the late 1950s. The sludge was generated during the cleaning of two No. 6 fuel oil tanks, designated as IHSSs 105.1 and 105.2 (listed jointly as IHSS 105 below). The area was backfilled when disposal operations ceased. Analyses of data obtained from the RFI/RI Report suggest that materials disposed at IHSS 102 have not caused subsurface contamination and are not a source for groundwater contamination.

- **IHSS 103, Chemical Burial Site.** An area south of Building 881 was reportedly used to bury unknown chemicals. The exact location, dates of use, and contents of the site are unknown. No documentation was found during the historical release investigation that verifies the existence of this site. Based on the Phase III RFI/RI data, IHSS 103 does not appear to be a source for contamination.

- **IHSS 104, Liquid Dumping Site.** An area east of Building 881 was reportedly used for disposal of unknown liquids and empty drums prior to 1969. The exact location or dimensions of the pit were not reported. No documentation was found during the historical release investigation that verifies the existence of this site.

- **IHSSs 105, Out-of-Service Fuel Oil Tank Sites (105.1 and 105.2).** Located immediately south of Building 881, these storage tanks were for No. 6 fuel oil. Suspected leaks occurred during 1972. The tanks were closed in place through filling with asbestos-containing material and cement. The tanks were pressure tested in 1973 and no leaks were detected. IHSS 105 does not appear to be a source of contamination.

- **IHSS 106, Outfall Site.** An overflow line from the sanitary sewer sump in Building 887 was used for discharge of untreated sanitary wastes in the 1950s and 1960s. Due to concerns about discharges from the outfall entering Woman Creek, several small retention ponds and an interceptor ditch were built during 1955 and 1979, respectively. Based on the Phase III RFI/RI data, IHSS 106 does not appear to be a source for contamination.

- **IHSS 107, Hillside Oil Leak Site.** This is the site of a 1972 fuel oil spill from the Building 881 foundation drain outfall. A concrete skimming pond was built below the foundation drain outfall to contain the oil flowing from the foundation drain, and an interceptor ditch was constructed to prevent oil-contaminated water from reaching Woman Creek. Based on the Phase III RFI/RI data, IHSS 107 does not appear to be a source for contamination.

- **IHSSs 119.1, 119.2, Multiple Solvent Spill Sites.** These sites include former drum and scrap metal storage areas east of Building 881 along the southern perimeter road. The drums contained unknown quantities and types of solvents. The scrap metal may have been coated with residual oils and/or coolants. Groundwater data in the Phase III RFI/RI report suggest that released solvent waste is present at IHSS 119.1. However, based on the Phase III RFI/RI data, IHSS 119.2 does not appear to be a source for contamination.

- **IHSS 130, Radioactive Site - 800 Area #1.** An area east of Building 881 was used between 1969 and 1972 to dispose of soil and asphalt contaminated with low levels of plutonium and uranium. IHSS 130 contains plutonium and uranium-contaminated soil and asphalt which was a result of the 1969 fire at Building 776, road contamination from Eighth Avenue and contaminated soil removed from around Building 774 process waste tanks. Localized areas within the IHSS contain low activities of americium or plutonium. Based on the Phase III RFI/RI data, IHSS 130 has been found not to pose a human health or environmental risk, and does not appear to be a source of contamination.

- **IHSS 145, Sanitary Waste Line Leak.** This is a six-inch cast-iron sanitary sewer line that originated at the Building 887 lift station and that leaked on the hillside south of Building 881. The line had conveyed sanitary wastes and low-level radioactive laundry effluent to the sanitary treatment plant from about 1969 to 1973. Based on the Phase III RFI/RI data, IHSS 145 does not appear to be a source for contamination.

Each of these IHSSs was originally identified as a potential source of groundwater contamination at OU 1. The Phase III RFI/RI, however, concluded that only IHSS 119.1 contains a significant source of contamination in the form of residual ***dense non-aqueous phase liquids*** (DNAPLs) assumed to be present in subsurface soil. Additional analysis has found that the contaminated area is small and the contamination is relatively immobile. Other IHSSs in OU 1 were not found to be source areas and do not contribute significantly to groundwater contamination.

Interim Actions / Accelerated Actions

During 1992 a French Drain was constructed across a portion of the operable unit to protect Woman Creek from contaminated groundwater present in OU 1. The drain, along with an extraction well, installed upon completion of the drain, collects contaminated groundwater moving towards Woman Creek. Collected groundwater is pumped to an ***Ultraviolet/Hydrogen Peroxide (UV/H_2O_2)*** and ion-exchange water treatment system located in Building 891.

Plutonium contaminated surface soil "hot spots" that were located in IHSSs 119.1 and 119.2 were removed from OU 1 during 1994. The hot spot removal was conducted under an Accelerated Response Action per the IAG. Any surface soil contamination remaining at OU 1 has been transferred administratively to OU 2 and will be addressed jointly with surface soil contamination at OU 2 (Reference: DOE letter 94-DOE-07024 to EPA and CDPHE dated June 30, 1994).

Surface water and suspended sediments transported from OU 1 have historically flowed into Woman Creek or the south interceptor ditch (SID). Since Woman Creek and the SID are being evaluated as part of OU 5: Woman Creek Priority Drainage, surface water and associated sediments originating from OU 1 are being addressed as part of OU 5. Therefore, this Proposed Plan addresses the removal of contamination sources

in subsurface soils, thereby preventing any further contamination of groundwater.

SUMMARY OF SITE RISKS

As part of the Phase III RFI/RI conducted for OU 1, a ***Baseline Risk Assessment (BRA)*** was prepared to identify any current or potential future risks to human health and the environment. The BRA evaluated health risks from surface soil, subsurface soil, groundwater, surface water, and sediments within the OU 1 boundaries.

The surface soil hotspot removal action conducted at OU 1 for plutonium, americium, and uranium contamination reduced the risk from this contaminant group and medium by 100 times. The risk from surface soils was reduced to one in 100,000 (10^{-5}) after the OU 1 hot spot removal was completed. This contaminant group contributed the highest risk to a human receptor in the OU 1 BRA. With respect to subsurface soils and groundwater, the primary contaminants identified in the Phase III RFI/RI were:

- ***carbon tetrachloride (CCl_4)***
- ***1,1-dichloroethene (1,1-DCE)***
- ***tetrachloroethene (PCE)***
- ***1,1,1-trichloroethane (1,1,1-TCA)***
- ***trichloroethene (TCE)***
- ***selenium***

The BRA identified potential health risks from these contaminants associated with current and possible future exposure scenarios at OU 1. The scenarios originally examined in the OU 1 BRA are listed below. However, not all of these scenarios are considered valid or currently possible.

- current on-site commercial/industrial
- current off-site residential
- future on-site commercial/industrial
- future on-site ecological reserve
- future on-site residential

The Rocky Flats Future Site Use Working Group, consisting of participants from DOE, EPA, CDPHE, and major stakeholders, recommended in the June 1995 "Future Site Use Recommendations" report that the future on-site residential land use scenario not be considered. The commercial/industrial exposure scenario was recommended for use within the industrial area of the plant and the open space exposure scenario was recommended for the buffer zone of the plant. These recommendations are consistent with the conceptual land uses in the Action Level Framework in the draft RFCA and with the draft Rocky Flats Vision. The OU 1 area lies on the border between these two anticipated land uses. DOE has not yet made a final determination regarding the future land uses for OU 1. This determination will be consistent with RFCA and the Rocky Flats Vision and will take into consideration the fact that the hillside at OU 1 has shown the potential for landslides and slumping. This would make the construction of structures at OU 1 complicated and problematic. Determinations on future groundwater use at OU 1 will also be consistent with RFCA and the Rocky Flats Vision, including the Action Level Framework.

There are no health risks associated with the future open space park exposure scenario from OU 1 subsurface soil or groundwater since there are no exposure routes available from either medium. The carcinogenic risk calculated in the OU 1 BRA for the future on-site commercial/industrial worker in the industrial area from subsurface soils and ground water is $2.4X10^{-4}$. This risk is slightly above the EPA's acceptable risk range of 10^{-4} to 10^{-6}.

The Phase III RFI/RI identified no other significant environmental risk; therefore, environmental risks warrant no further examination.

SUMMARY OF REMEDIAL ACTION ALTERNATIVES

The following remedial action alternatives were identified and subjected to a detailed analysis to identify a preferred remedy for OU 1.

- **Alternative 0: No Action.** This alternative was identified as a baseline against which other alternatives could be compared. Under this alternative the French Drain would be decommissioned and the site would be released for unrestricted use.

- **Alternative 1: Institutional Controls with the French Drain.** This alternative represents the existing conditions at OU 1. Under this alternative, the existing French Drain would continue to collect groundwater flowing from the 881 Hillside Area and treat it when necessary, using the existing Building 891 water treatment system. Institutional controls would be implemented that would reduce exposure to soil and groundwater contamination. The controls, such as legal restrictions on land use, would be

designed to prevent inappropriate construction in the area and use of the groundwater.

- **Alternative 2: Groundwater Pumping and Soil Vapor Extraction.** This alternative consists of pumping the groundwater found beneath the IHSS 119.1 area (the most contaminated region in OU 1) to remove groundwater from the ***saturated zone*** to the maximum extent practical, and then applying ***soil vapor extraction*** (SVE) to remove contaminants found in the subsurface soil zone. Extracted groundwater would be treated using the existing Building 891 water treatment system, and extracted vapors would be treated via ***carbon adsorption*** or ***catalytic oxidation***.

- **Alternative 3: Groundwater Pumping and Soil Vapor Extraction with Thermal Enhancement.** This alternative is identical to the preceding alternative except that it includes heating subsurface soils, prior to implementing SVE, to increase the treatment range of the vapor extraction system. Subsurface soils would be heated through either ***radio frequency*** (RF) heating or ***ohmic (electrical resistance) heating***. Contaminant extraction efficiencies would be increased through heating by assisting the ***volatilization*** of contaminants, and by opening blocked ***pore spaces*** in the soil matrix.

- **Alternative 4: Hot Air Injection with Mechanical Mixing.** This alternative utilizes a drill rig with a large, wide-bladed auger to forcefully mix subsurface soils while injecting steam to help volatilize and extract contaminants. Groundwater present at the drilling point would be extracted through the hollow auger and would be treated using the existing Building 891 water treatment system.

- **Alternative 5: Soil Excavation with Groundwater Pumping.** This alternative targets removal of the most contaminated soils beneath IHSS 119.1. Although the primary concern at OU 1 is groundwater contamination, this alternative would remove potential residual sources of contamination found in the soils themselves, while extracting groundwater for treatment in the existing Building 891 water treatment system. Excavated soils may be thermally treated and disposed on or off site, or disposed of on site or off site with no treatment.

EVALUATION OF ALTERNATIVES

A detailed analysis of alternatives, conducted as part of the CMS/FS, evaluated each of the remedial action alternatives with respect to the criteria listed below. The size of the Alternative 5 soil excavation evaluated in the CMS/FS was 200 feet by 200 feet. The area of subsurface soil contamination has been more accurately defined through the use of a ***soil gas survey.*** The results of the soil gas survey, which are presented in "Sampling and Analysis Report-Identification and Delineation of Contaminant Source Area for Excavation Design Purposes," found in the Administrative Record for OU 1, support an estimated excavation area of 50 feet by 50 feet by 12 feet deep (between 1000 and 2000 cubic yards of soil). This estimate is used to evaluate Alternative 5 in the following comparison of alternatives. In addition, the DRC independently evaluated the alternatives proposed in the CMS/FS in order to recommend a preferred alternative. The DRC evaluations are incorporated into the evaluation presented below.

- **Overall Protection of Human Health and the Environment**. This is a threshold criterion and is used to evaluate the conclusions of other criteria. The criterion is used to evaluate how human health and environmental risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

  Alternative 5 provides the largest reduction in exposure potential within the shortest amount of time once the remediation is begun.

  Alternatives 2, 3, 4, and 5 reduce the exposure potential by remediating the source of contamination. Alternative 1 reduces the exposure potential by containing and treating contaminated groundwater, as well as by limiting access to the site. Alternative 0 offers the least protection of the alternatives considered since it does not include any source removal or containment.

- **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).** This criterion evaluates the degree to which the various alternatives meet chemical-specific, action-specific, and location-specific requirements. ARARs are requirements that would apply to the site or contaminant if the remedial action was not being conducted under CERCLA. ARARs are also requirements that apply to similar activities, locations, or chemicals

and that are deemed appropriate for the particular proposed remedial action.

Section 121(b) of CERCLA requires remedial actions to comply with the ARARs identified for the action. Key potential ARARs analyzed for each alternative include:

- Colorado Basic Standards for Groundwater - 5 CCR 1002-8,m3.11.5 and 3.11.6
- Colorado CHWA (RCRA) Regulations - 6 CCR 1007-3 Parts 264 and 268
- Colorado Air Pollution Control Regulations - 5 CCR 1001-5, Regulation 7
- Colorado Nongame, Endangered or Threatened Species Conservation Act-CRS 33-2-101.

Alternatives 2, 3, 4, and 5 should meet the Colorado groundwater protection standards at IHSS 119.1. All alternatives evaluated in the detailed analysis should meet the other key potential ARARs identified above.

- **Long-Term Effectiveness and Permanence.** This criterion evaluates the long-term protectiveness and permanence of the alternatives. Preference is given to treatment alternatives since they involve removal of contaminants or conversion of contaminants to an innocuous form.

  Alternative 5 provides the highest level of long-term effectiveness and permanence since it removes both groundwater contamination and potential residual subsurface sources from OU 1. Alternatives 2, 3, and 4 may also remove the source but these methods are not effective given the site characteristics (clay soil) at OU 1.

  Alternative 1 provides the next highest level of effectiveness and permanence since it involves collection and treatment of contaminated groundwater and thus reduces contamination at OU 1. Alternative 0 ranks lowest under this criterion since it does not treat or remove any contamination.

- **Reduction of Toxicity, Mobility, or Volume Through Treatment.** This criterion evaluates the ability of the alternatives to reduce the risks at the site through destruction of contaminants, reduction of the total mass of contamination, reduction of contaminant mobility, or reduction of contaminated media volume. The NCP and RCRA guidance give preference to alternatives that involve treatment.

  Alternative 5 provides the highest reduction of mobility because it removes the primary source of contamination and thereby prevents any further migration of contaminants. In addition, if the excavated material is treated, as discussed above in the "Summary of Remedial Action Alternatives," Alternative 5 also provides the highest reduction of toxicity and volume. Alternatives 2, 3, and 4 provide the next highest level of toxicity, mobility, and volume reduction since they target the contaminant source area identified at IHSS 119.1. Alternative 1 provides the next highest level of reduction since it would collect and treat contaminated groundwater from OU 1. Alternative 0 provides no reduction in toxicity, mobility, or volume of contaminants.

- **Short-Term Effectiveness.** This criterion evaluates community, environmental, and site-worker protection during the implementation of the remedy. This criterion also addresses the effectiveness and reliability of protective measures during implementation, and the time until protection is achieved.

  Alternatives 0 and 1 rank highest under the site-worker protection portion of this criterion because they involve no disturbance of the existing site and little or no worker involvement. The site disturbance that will be part of Alternatives 2, 3, 4 and 5 is not expected to create a significant impact on the community, the environment or site workers. Alternative 3, however, may present increased potential hazards to workers due to the heating of the subsurface soil.

  Alternative 5 ranks highest on the effectiveness and reliability of protective measures during implementation, and on time until protection is achieved once implementation has begun. DOE anticipates that it will take four to six months for protection to be achieved with Alternative 5 once implementation has begun. The corresponding timeframe for Alternatives 4, 3 and 2 is two years, three years and five years, respectively. The corresponding timeframe for Alternatives 0 and 1 is indefinite and quite extensive since these alternatives do not involve any source removal.

- **Implementability.** This criterion evaluates the technical and administrative feasibility of implementing the alternatives including the availability of materials, services needed during implementation and the ability to monitor the effectiveness of remedy. This criterion is

especially important for evaluating reliability of less proven technologies or those that rely on limited supplies of equipment, vendors, or specialized workers.

All of the alternatives are implementable, with Alternatives 0 and 1 being the most easily implementable. Alternative 0 involves only decommissioning the french drain and performing groundwater monitoring, and Alternative 1 involves only the continuation of current interim measures.

Alternatives 2, 3, and 4 use intrusive treatments that may pose technical problems. In particular, soil vapor extraction cannot be reliably conducted in clay soils and is, therefore, more difficult to implement than simply excavating the soils as in Alternative 5. Also, the effectiveness of Alternative 5 can be most easily monitored. Alternative 3 is more difficult to implement than Alternative 2 because it is still an experimental technology. Alternative 4 is the most difficult to implement because of the sloping, unstable hillside and the limited supply of the specialized equipment that is needed.

- **Cost.** This criterion evaluates the capital cost for each alternative, long-term operation and maintenance (O&M) expenditures required to sustain it, and post-closure costs occurring after the completion of remediation. Future expenditures are adjusted to present worth amounts by discounting all costs to a common base year using present worth cost analysis.

  Alternative 0 is the least costly since it involves only the continuation of groundwater monitoring, with no treatment plant operation. The total estimated costs of Alternative 0 is $1,900,000.

  Alternative 5 is the next least costly with respect to Alternative 0. From the soil gas survey results, DOE estimates that the actual excavation will be approximately 50 feet by 50 feet by 12 feet deep (approximately 1000 to 2000 cubic yards of soil). The estimated costs for Alternative 5 are $3,300,000, $3,500,000 and $3,900,000, respectively, depending upon which of the following soil disposal methods are used: contaminated soil placed directly into an on-site waste cell, thermal decontamination with the soil placed into the original excavation, and thermal decontamination with off-site disposal. These estimates include all costs of excavation, handling and management of soil, operation of the french drain and treatment plant for one year, and groundwater monitoring for thirty years.

  Alternative 4 is the next least costly with an estimated total cost of $4,300,000. This assumes operation of the french drain and treatment plant for two years. Alternative 3 is the next least costly with an estimated cost of $7,500,000, which assumes operation of the french drain and treatment plant for three years. Alternative 2 with an estimated cost of $8,100,000 is the next least costly. This assumes operation of the french drain and treatment plant for five years. DOE anticipates that in Alternatives 2, 3, 4 and 5, the french drain will be decommissioned following removal of the contamination source in the subsurface soil.

  The total estimated cost of Alternative 1 is $17,500,000 which is the most costly alternative due to the continued operation of the french drain and the treatment plant for thirty years.

- **State Acceptance.** This criterion addresses the State or support agency's comments and concern regarding the appropriateness of the proposed alternative.

  As a result of negotiations with the EPA, DOE and the CDPHE, the DRC has chosen Alternative 5 as the preferred remediation alternative. The excavation of the contaminated subsurface soils will eliminate most of the source for further groundwater contamination. A soil gas survey has been completed that will help designate the area of excavation.

- **Community Acceptance**. This criterion is used to evaluate the proposed remedial action alternative in terms of issues and concerns raised by the public. Public involvement is encouraged through public hearings and submittal of public comments. The selection of a final remedy will include an evaluation of public concern and objections. Community acceptance will be discussed in the CAD/ROD.

- **Anticipated Damages to Natural Resources**. Alternative 0 will not result in any irreversible damages to natural resources, but will continue to degrade the quality of groundwater since the alternative does not involve any remedial activity.

  Alternative 1 will not result in any irreversible damages to natural resources and will improve the quality of groundwater by treatment.

  Alternatives 2, 3 ,4 and 5 will not result in any irreversible damages to natural resources and will

improve the quality of soil and groundwater by excavation and treatment.

Measures to control and reduce the risk of damages to natural resources will be considered prior to beginning the remedial activity.

A summary of this evaluation is presented in Table 1 at the end of this plan.

PREFERRED REMEDIAL ALTERNATIVE

The Preferred Alternative for OU 1 is Alternative 5: *Soil Excavation and Groundwater Pumping,* which is protective of human health and the environment, as well as consistent with the draft Rocky Flats Vision. The Dispute Resolution Committee selected *Soil Excavation and Groundwater Pumping* as the Preferred Alternative on August 25, 1995, as part of the dispute resolution process defined within the IAG.

The Preferred Alternative for OU 1 will be implemented as follows:

- A soil gas survey has been conducted in order to better characterize the amount and location of the contaminated soil. Before the subsurface soil is excavated, the best method for soil treatment and disposal will be determined based on cost, available technologies and total volume of soil excavated;

- DOE anticipates that the groundwater recovery and treatment system for OU 1 will operate until the contamination source in the subsurface soil has been excavated. At that point, DOE anticipates that the french drain will be decommissioned. Further operation of the groundwater treatment plant will be consistent with the Final Groundwater Conceptual Plan for RFETS;

- Surface soil contamination has been transferred administratively to OU 2 and is being addressed jointly with surface soil contamination in OU 2;

- Surface water and associated sediments originating from OU 1 are being addressed as part of OU 5: Woman Creek; and

- IHSS 119.1 will be remediated consistent with its ranking in the Environmental Restoration Ranking (#12). This means that it may not be remediated immediately following the final CAD/ROD for OU 1. The remediation of IHSS 119.1 may also be affected, however, by funding, data sufficiency, resource availability and integration with other remedial and site activities. Based on some of these factors, the remediation of IHSS 119.1 could occur as early as fiscal year 1997, or several years after the final OU 1 CAD/ROD.

Although this Proposed Plan identifies *Soil Excavation And Groundwater Pumping* as the preferred alternative for OU 1, the Public is encouraged to review and comment on all of the remedial alternatives considered for OU 1.

GLOSSARY

Administrative Record. The record of documents including correspondence, public comments, technical reports, etc., upon which the agencies based their remedial action selection.

1,1-Dichloroethene (1,1-DCE). 1,1-DCE is used in the manufacture of 1,1,1-TCA and as a cleaning solvent and degreaser. It is usually in the form of a colorless liquid with a chloroform-like odor. 1,1-DCE is considered a highly volatile and is classified as a Class C carcinogen.

1,1,1-Trichloroethane (1,1,1-TCA). 1,1,1-TCA is used as an industrial solvent and in consumer products. It is considered a volatile organic compound and is classified as a Class D carcinogen.

Baseline Risk Assessment (BRA). An assessment of the risks to human health and the environment at a site. BRA methodology utilizes contaminant concentrations and potential exposure routes to quantify risks associated with present and future site conditions.

Biodegradation. *The breakdown of contaminants to* other chemical or physical forms by bacteria, fungi, and other microorganisms. Biodegradation can be applied in the ground or in a treatment unit and can be used under aerobic or anaerobic conditions.

Carbon Adsorption. A treatment which traps organic and some inorganic contaminants from air or water on an activated carbon surface as the contaminated stream is passed through a carbon containing vessel. The contaminated carbon can be destroyed or regenerated.

Carbon Tetrachloride (CCl_4). CCl_4 is used as an industrial solvent which is most often used as a cleaning fluid. It is considered a volatile organic compound and is classified as a Class D carcinogen.

Catalytic Oxidation. A treatment which destroys organic contaminants in an air stream by oxidizing the contaminants in a special reaction vessel. The vessel contains a catalyst which speeds the oxidation and lowers the temperature needed for complete oxidation.

Colorado Hazardous Waste Act (CHWA). The State act through which RCRA is administrated.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A Federal law passed in 1980 that establishes a program to identify abandoned hazardous waste sites, ensures that they are cleaned up, evaluates damages to natural resources and creates claims procedures for parties who cleaned up the sites. The scope of CERCLA was expanded in 1986 by the Superfund Amendments and Reauthorization Act, which, among other things, guarantees greater public input and involvement in remedy selection and cleanup activities.

Corrective Action Decision/Record of Decision (CAD/ROD). A document that explains which cleanup option(s) are selected at a RCRA/CERCLA site. The CAD/ROD is based on information obtained from the RFI/RI, the CMS/FS, and community participation.

Corrective Measures Study/Feasibility Study (CMS/FS). The CMS/FS identifies and evaluates the most appropriate technical approaches for addressing environmental contamination. Specific factors from CERCLA and RCRA guidance are assessed through this study.

Dense Non-Aqueous Phase Liquids (DNAPLs). DNAPL contamination can be in either free-phase (immiscible liquid) or residual form in the subsurface. Residual DNAPL is typically confined to soil pore spaces both above and below the water table. DNAPLs are more dense than water and therefore have a tendency to accumulate in low points.

Dispersion. The distribution of contamination within a larger volume resulting in lower concentrations throughout as the plume disperses and expands. Similar to dilution.

Dispute Resolution Committee (DRC). The committee specified within the IAG to resolve disputes which are a part of the formal dispute resolution process. The designated members of the DRC from the State, DOE Rocky Flats Field Office, and EPA are, respectively, Chief of the Hazardous Waste Control Section, Assistant Manager for Environmental Management, and Region 8 Hazardous Waste Management Division Director.

Final Groundwater Conceptual Plan for RFETS. The recently developed document to prioritize and remediate contaminated groundwater at Rocky Flats.

French Drain. An underground drain consisting of loose stones or gravel covered by soil which serves to collect groundwater in sumps, or divert the flow of groundwater in a particular direction.

Individual Hazardous Substance Site (IHSS). An area which has been identified as being potentially contaminated as a result of previous operations.

Interim Measure/Interim Remedial Action (IM/IRA). An early action taken to control a release or threatened release of hazardous substances. IM/IRAs are typically conducted prior to full characterization of a site as they are actions intended to limit future contamination.

Interagency Agreement (IAG). The January 22, 1991 document prepared by representatives from DOE, EPA and CDPHE. It presents the objectives and general protocols for addressing the cleanup or evaluation of each of the operable units at the Rocky Flats Environmental Technology Site.

Ohmic (electrical resistance) heating. The use of six-phase electrical power to heat subsurface soils and increase contaminant volatilization. The process uses grids of six antennae placed in a hexagonal well array.

Operable Unit (OU). A term used to describe a certain portion of a CERCLA site. An operable unit may be established based on a particular type of contamination, contaminated media (e.g., soil, water), source of contamination and/or geographical location.

Pore Spaces. The small spaces between soil particles which can be occupied by water or air. Pore spaces may or may not be open to transport groundwater.

Preferred Alternative. The protective, ARAR-compliant approach that is judged to provide the best balance of tradeoffs with respect to long- and short-term effectiveness, implementability, cost and the reduction of contaminant toxicity, mobility, or volume through treatment.

Proposed Plan (PP). A public document that first introduces the lead agency's preferred option for addressing a contaminated site. The PP is produced through the cooperation of the lead and regulatory agencies and is reviewed by the public.

Radio Frequency. The use of radio frequency energy to heat subsurface soils and increase contaminant volatilization. Antennae are placed in vertical or horizontal wells and produce radio waves which heat the surrounding soils.

Remedial Action Objectives (RAOs). RAOs are contaminant- and medium-specific goals for protecting human health and the environment.

Resource Conservation and Recovery Act (RCRA). A Federal law passed in 1976 that is designed to require the "cradle-to-grave" management of hazardous waste. CDPHE, through the Hazardous Materials and Waste Management Division, implements RCRA in Colorado. CDPHE has issued a RCRA operating permit for Rocky Flats.

RCRA Facility Investigation/ Remedial Investigation (RFI/RI). An RFI/RI involves collecting and analyzing information to determine the nature and extent of contamination that may be present at a site. This may include risk assessment and modeling activities.

Responsiveness Summary. The portion of the CAD/ROD that summarizes public and agency review comments and provides responses to these comments.

Rocky Flats Cleanup Agreement. The draft agreement that will provide the regulatory framework under which the Rocky Flats Environmental Technology Site will be cleaned up and that will set enforceable milestones on an annual basis. This draft agreement was released for public comment on March 14, 1996.

Rocky Flats Vision. The draft document that will present the vision, philosophies and policies that will direct cleanup decisions at the Rocky Flats Environmental Technology Site. This draft document was released for public comment on March 14, 1996.

Saturated zone. The portion of the subsurface which is completely saturated by groundwater, that is, the area of soil beneath the water table.

Selenium. Selenium is an inorganic (metal) nutrient whose toxicity is related to its chemical form. Selenium is classified as a Class D carcinogen. Selenium is naturally occurring at varying concentrations throughout the Rocky Flats Environmental Technology Site area.

Soil gas survey. A method of evaluating whether soil contains volatile material. A metal rod in driven or pushed into the soil, vapors are extracted through the rod, and analyzed

Soil vapor extraction (SVE). An in-situ treatment for organic contamination in subsurface soils which transfers contaminants from the soil and water in pore spaces to air. Contaminants are then removed from the subsurface by extraction wells fitted with vacuum pumps.

Tetrachloroethene (PCE). PCE is an industrial solvent used widely in the dry cleaning and textile industries. It is also used as a degreaser and has a variety of commercial applications. PCE is considered a volatile organic compound and is classified as a Class D carcinogen.

Trichloroethene (TCE). TCE, like PCE is an industrial solvent that is considered a volatile organic compound. Toxicity data is not available for TCE, therefore it is typically not included in risk assessment calculations.

Ultraviolet/Hydrogen Peroxide (UV/H_2O_2). A treatment which combines exposure of contaminated water to ultraviolet light (UV) with the addition of hydrogen peroxide (H_2O_2). Both provide free radicals which catalyze the breakdown of contaminants to innocuous chemicals.

Volatilization. The process of changing from a liquid state to a gaseous state. This action can be accelerated through the addition of heat or through reducing ambient pressure conditions.

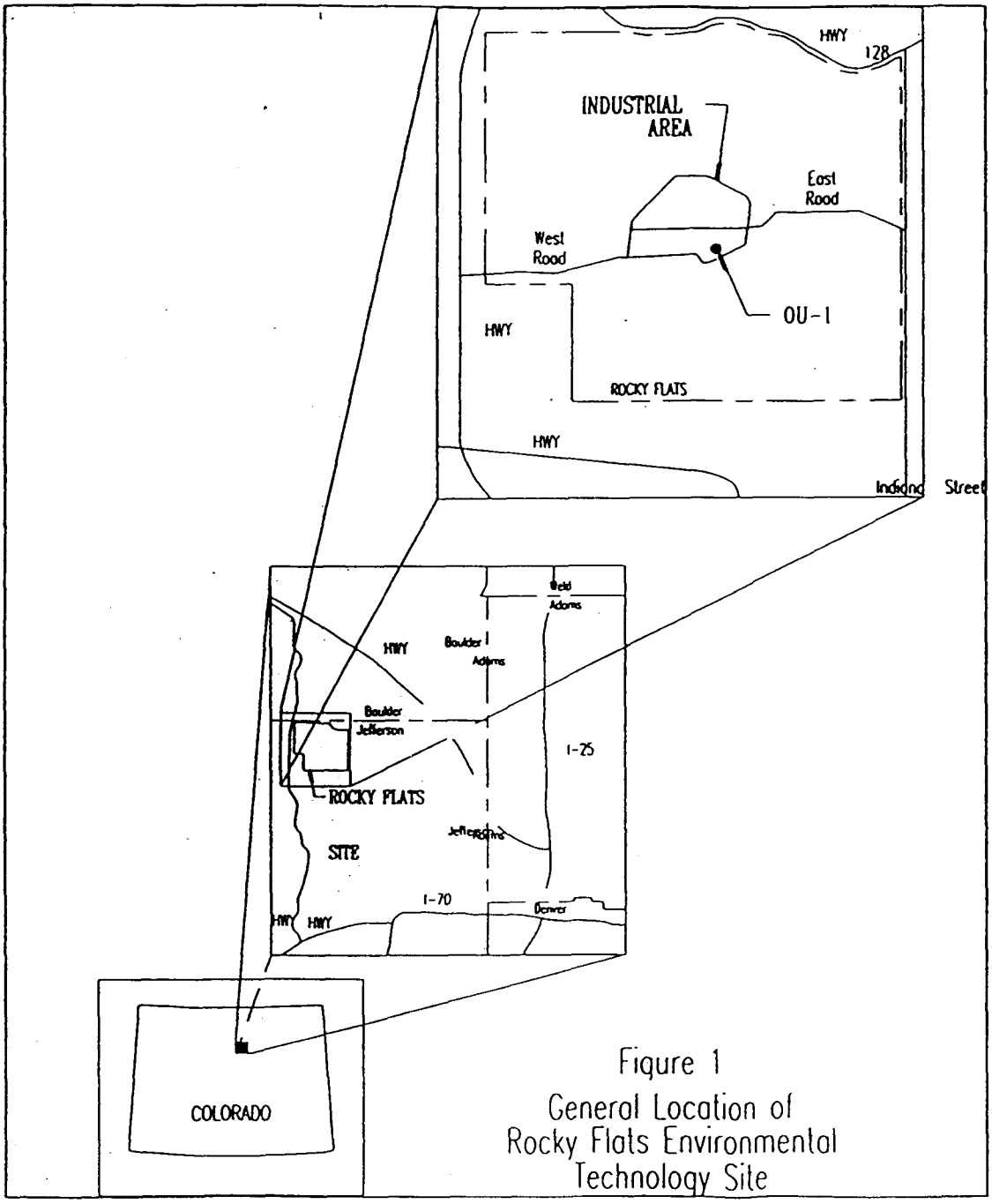

Figure 1
General Location of
Rocky Flats Environmental
Technology Site

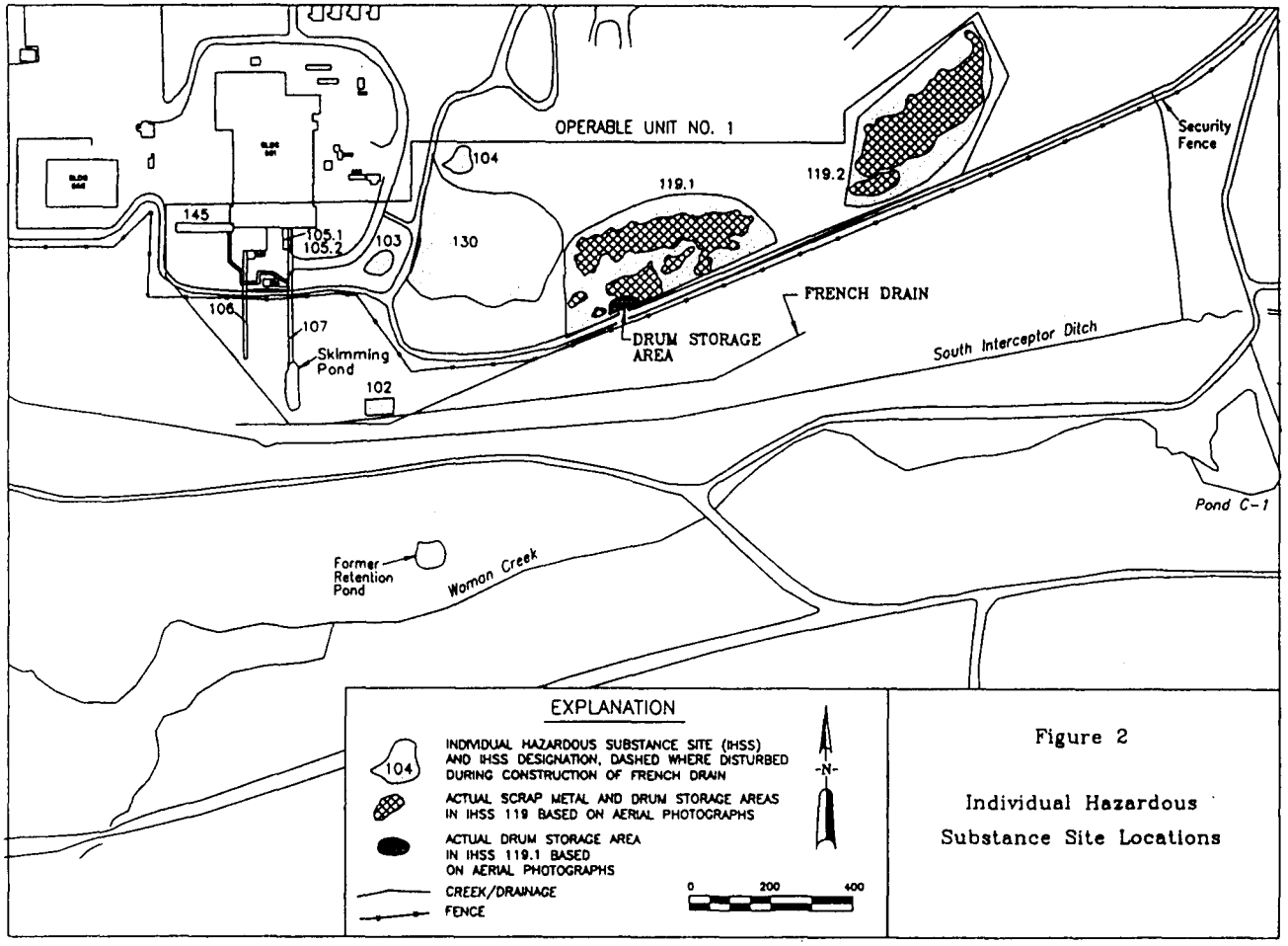

Figure 2

Individual Hazardous Substance Site Locations

EVALUATION OF ALTERNATIVES

	Alternative 0	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Overall Protection of Human Health and Environment	P	F	G	G	G	B
Compliance with ARARs	F	F	G	G	G	B
Long-Term Effectiveness and Permanence	P	F	G	G	G	B
Reduction of Toxicity, Mobility, or Volume Through Treatment	P	F	G	G	G	B
Short-Term Effectiveness	F	F	F	F	F	G
Time Until Protection is Achieved	Indefinite	Indefinite	5 Years	3 Years	2 Years	4-6 Months
Implement-ability	B	B	F	F	P	G
Cost	$1.9 million	$17.5 million	$8.1 million	$7.5 million	$4.3 million	$3.3-3.9 million
Anticipated Damages to Natural Resources	P	F	G	G	G	G

B = Best
G = Good
F = Fair
P = Poor

TABLE 1